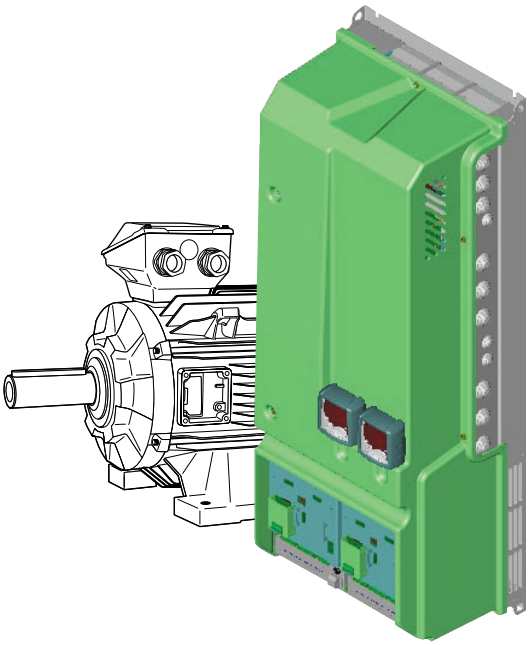
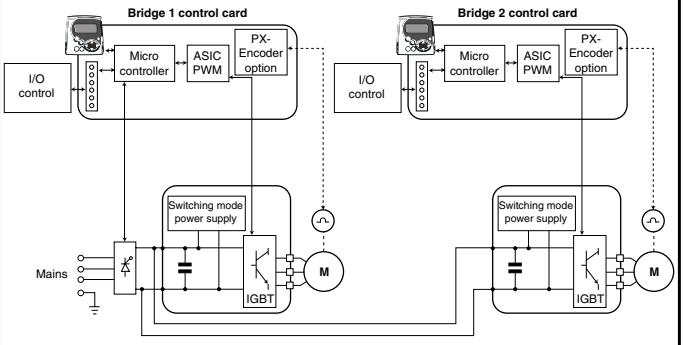
LEROY SOMER

3865 en - 11.2005 / b



This manual is to be given to the end user



POWERDRIVE

Dual output variable speed drive

Installation manual

POWERDRIVE
Dual output variable speed drive

NOTE

LEROY-SOMER reserves the right to modify the characteristics of its products at any time in order to incorporate the latest technological developments. The information contained in this document may therefore be changed without notice.

⚠ CAUTION

For the user's own safety, this variable speed drive must be connected to an approved earth (⏚ terminal).

If accidentally starting the installation is likely to cause a risk to personnel or the machines being driven, it is essential to comply with the power connection diagrams recommended in this manual.

The variable speed drive is fitted with safety devices which, in the event of a fault, control stopping and thus stop the motor. The motor itself can become jammed for mechanical reasons. Voltage fluctuations, and in particular power cuts, may also cause the motor to stop. The removal of the causes of the shutdown can lead to restarting, which may be dangerous for certain machines or installations.
In such cases, it is essential that the user takes appropriate precautions against the motor restarting after an unscheduled stop.

The variable speed drive is designed to be able to supply a motor and the driven machine above its rated speed.
If the motor or the machine are not mechanically designed to withstand such speeds, the user may be exposed to serious danger resulting from their mechanical deterioration.
It is important that the user checks that the installation can withstand it, before programming a high speed.

The variable speed drive which is the subject of this manual is designed to be integrated in an installation or an electrical machine, and can under no circumstances be considered to be a safety device. It is therefore the responsibility of the machine manufacturer, the designer of the installation or the user to take all necessary precautions to ensure that the system complies with current standards, and to provide any devices required to ensure the safety of equipment and personnel.

LEROY-SOMER declines all responsibility in the event of the above recommendations not being observed.

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This manual only describes the general features, characteristics and installation of the POWERDRIVE. For commissioning, refer to manual 3871.

POWERDRIVE
Dual output variable speed drive

SAFETY AND OPERATING INSTRUCTIONS FOR VARIABLE SPEED DRIVES
(In accordance with the low voltage directive 73/23/EEC modified by 93/68/EEC)

• Throughout the manual, this symbol warns of consequences which may arise from inappropriate use of the drive, since electrical risks may lead to material or physical damage as well as constituting a fire hazard.

1 - General
Depending on their degree of protection, the variable speed drives may contain unprotected live parts, which may be moving or rotating, as well as hot surfaces, during operation. Unjustified removal of protection devices, incorrect use, faulty installation or inappropriate operation could represent a serious risk to personnel and equipment.
For further information, consult the manual.
All work relating to transportation, installation, commissioning and maintenance must be performed by experienced, qualified personnel (see IEC 364 or CENELEC HD 384, or DIN VDE 0100 and national specifications for installation and accident prevention).
In these basic safety instructions, qualified personnel means persons competent to install, mount, commission and operate the product and possessing the relevant qualifications.

2 - Use
Variable speed drives are components designed for integration in installations or electrical machines.
When integrated in a machine, commissioning must not take place until it has been verified that the machine conforms with directive 89/392/EEC (Machinery Directive). It is also necessary to comply with standard EN 60204, which stipulates in particular that electrical actuators (which include variable speed drives) cannot be considered as circuit-breaking devices and certainly not as isolating switches.
Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (89/336/EEC, modified by 92/31/EEC) are met.
The variable speed drives meet the requirements of the Low Voltage Directive 73/23/EEC, modified by 93/68/EEC. The harmonised standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/ VDE 0558 are also applicable.
The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

3 - Transportation, storage
All instructions concerning transportation, storage and correct handling must be observed.
The climatic conditions specified in the technical manual must be observed.

4 - Installation
The installation and cooling of equipment must comply with the specifications in the manual supplied with the product.
The variable speed drives must be protected against any excessive stress. In particular, there must be no damage to parts and/or modification of the clearance between components during transportation and handling. Avoid touching the electronic components and contact parts.
The variable speed drives contain parts which are sensitive to electrostatic stresses and may be easily damaged if handled incorrectly. Electrical components must not be exposed to mechanical damage or destruction (risks to health!).

5 - Electrical connection
When work is performed on variable speed drives which are powered up, the national accident prevention regulations must be respected.
The electrical installation must comply with the relevant specifications (for example conductor cross-sections, protection via fused circuit-breaker, connection of protective conductor). More detailed information is given in the manual.
Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, earthing, presence of filters and correct insertion of cables and conductors, are given in the documentation supplied with the variable speed drives. These instructions must be followed in all cases, even if the variable speed drive carries the CE mark. Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

6 - Operation
Installations in which variable speed drives are to be integrated must be fitted with additional protection and monitoring devices as laid down in the current relevant safety regulations, such as the law on technical equipment, accident prevention regulations, etc. Modifications to the variable speed drives using control software are permitted.
Active parts of the device and the live power connections must not be touched immediately after the variable speed drive is powered down, as the capacitors may still be charged. In view of this, the warnings fixed to the variable speed drives must be observed.
During operation, all doors and protective covers must be kept closed.

7 - Servicing and maintenance
Refer to the manufacturer's documentation.

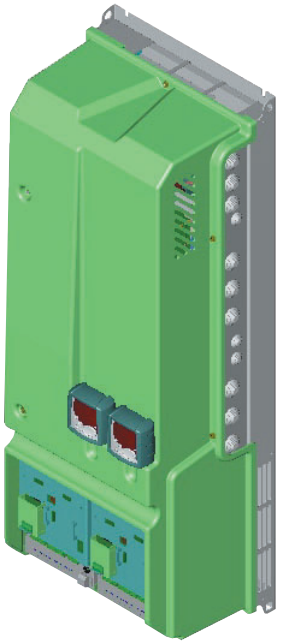
This manual is to be given to the end user.

POWERDRIVE
Dual output variable speed drive

FOREWORD

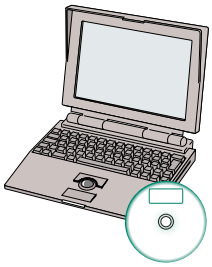
This manual describes the installation of **POWERDRIVE** variable speed drives. It also gives details of all its options and extensions which the user may choose to suit his requirements.

POWERDRIVE



Parameter setting

MD-LCD console



POWERSOFT Parameter-setting software

Parameter cloning

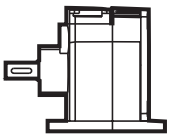
XPressKey

Options

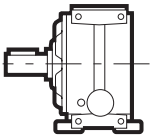
- **IP20 protection (with cover)**
- **RFI filter**
- **Mains choke**
- **Additional I/O (PX-I/O)**
- **Incremental encoder input or Hall effect sensor (PX-Encoder)**
- **Safety input category 2 or 3**
- **Fieldbus management (SM-PROFIBUS DP, SM-DeviceNet, SM-CanOpen, SM-INTERBUS, SM-Ethernet)**
- **Modbus RTU management**
- **Braking resistor and transistor**
- **Parameter saving with modem link or GSM**

Dual output

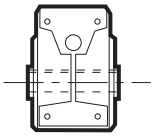
Gearboxes



• Axial output - Helical gears

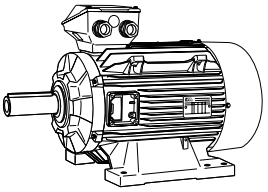


• Right-angled output - Helical bevel gears

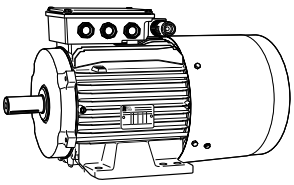


• Right-angled output - Worm gear

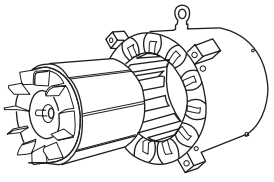
Induction motors



LS motor

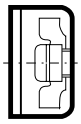


LS - MV motor



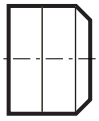
HPM motor

Motor options



Axial forced ventilation

Encoder



Brake

Radial forced ventilation

POWERDRIVE
Dual output variable speed drive

CONTENTS

Notes

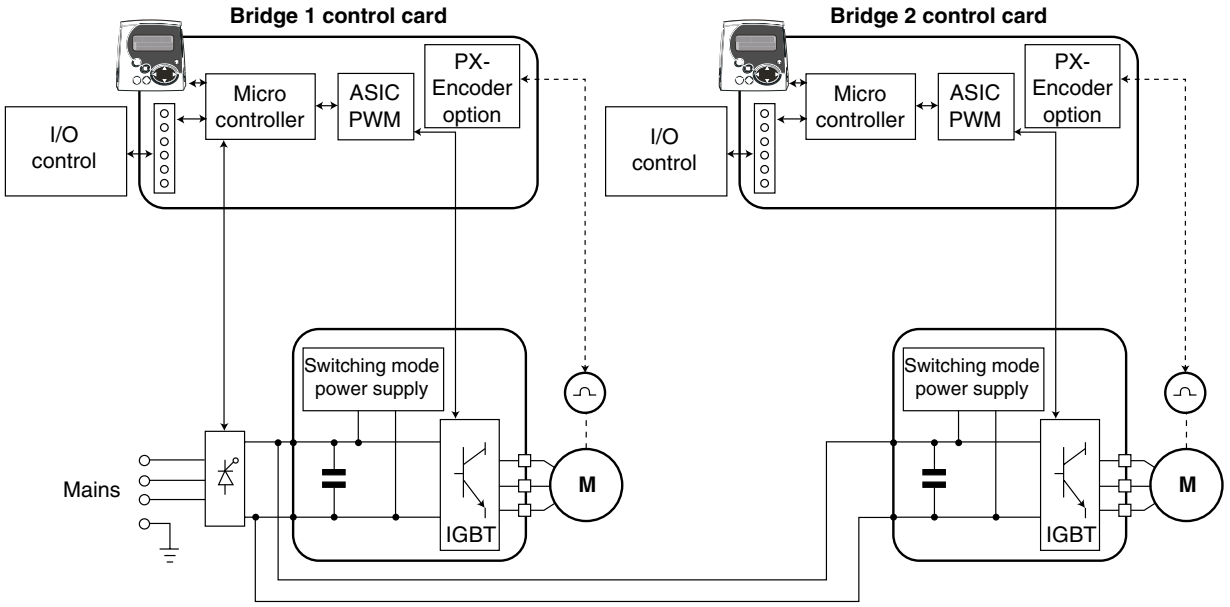
1 - GENERAL INFORMATION

1.1 - General

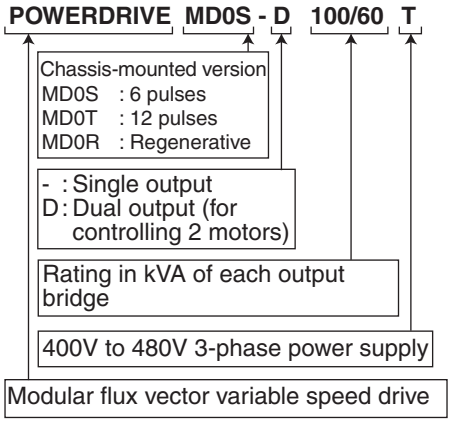
The **POWERDRIVE** is a modular electronic drive with flux vector control particularly suitable for supplying power to HPM (Hybrid Permanent Magnet) motors.
The special feature of the D (dual output) drive is that it has 2 IGBT transistor inverter bridges for a single rectifier bridge.

The performance of the **POWERDRIVE** is totally compatible with use in all 4 quadrants of the torque-speed plane.
During periods of operation as a generator, the energy restored by one of the motors can be used by the other motor.

Diagram



1.2 - Product designation



Nameplate

LEROY SOMER
MOTEURS LEROY-SOMER
16015 ANGOULEME FRANCE

ENTREE - INPUT				
Ph	V (V)	Hz (Hz)	I(A)	KVA
3	400/460	50/60	142/123	/

Alim aux 400V/50HZ 460/60Hz

CE

TYPE : **MD0S D 100/60T**

S/N : 09999999999

1.3 - Environmental characteristics

• Inexperienced personnel must not have access to the drive.

Characteristics	Level
Protection	IP00: no cover Optional IP20: with cover
Storage and transport temperature	-25°C to +60°C. 12 months maximum, after which the drive must be switched on (power and electronics) for 24 hours every 6 months.
Operating temperature	-10°C to 40°C. Up to 50°C with derating (see section 1.4.3).
Relative humidity	• In accordance with IEC 60068-2-56. • < 90% non condensing.
Altitude	< 1000 m without derating. > 1000 m: operating temperature derating of 0.6°C per 100 m.
Vibrations	• In accordance with IEC 60068-2-6. • Exposed product: 2m/s^2 (9-200 Hz), 0.6mm (2-9 Hz) • Packaged product: 10m/s^2 (9-200 Hz), 3mm (2-9 Hz)
Shocks	Packaged product: In accordance with IEC 60068-2-29.
Atmospheric pressure	700 to 1060 hPa
Temperature cycle	In accordance with IEC 60068-2-14 -10°C to +46°C, 5 cycles

1.4 - Electrical characteristics

1.4.1 - General characteristics

Characteristics	Level
Phase voltage imbalance	2%
Maximum number of power-ups per hour	20
Input frequency	2% around the rated frequency (50 or 60 Hz)
Output frequency range	0 to 400 Hz
Power supply voltage	3-phase mains supply: 400 V -10% to 480 V +10% (T)
Electronics supply voltage	Single phase mains supply:400 V/50 Hz (±10%) or 460-480 V/60 Hz (±10%) P = 280 W

1.4.2 - Electrical characteristics at 40°C

CAUTION:
In its factory setting, the drive operates with a switching frequency of 3 kHz at an ambient temperature of 40°C.

I_{co}: Continuous output current.
P_{out}: Output power.
I_{max} (60 s): Maximum output current for 60 s every 600 s.
I_{max} (2 s): Peak output current for 2 s every 60 s.

For the output current values of motor 1 and motor 2, please refer to the ratings that correspond to each of the motor outputs.
For example, for a **POWERDRIVE** 100/60T, the output characteristics for motor 1 are 100T, and the output characteristics of motor 2 are 60T.

3-phase mains supply 400 V -10% to 480 V +10%

POWERDRIVE rating	Pout (kW)	I_{co} (A)	I_{max} (60 s) (A)	I_{max} (2 s) (A)
60 T	45	90	120	140
75 T	55	110	165	175
100 T	75	145	200	220
120 T	90	175	240	270

1.4.3 - Derating according to the temperature and switching frequency

POWERDRIVE rating	Temperature (°C)	I_{co} (A)		
		2 kHz	3 kHz	4 kHz
60 T	40°C	90	**90**	80
	50°C		75	
75 T	40°C	110	**110**	100
	50°C		100	
100 T	40°C	145	**145**	125
	50°C		125	
120 T	40°C	175	**175**	160
	50°C		155	

1.4.4 - Losses and dissipation

When installing the drive in a cabinet, special precautions should be taken with regard to the volume of the enclosure. It is essential to check that the heat dissipation is adequate:

Type	Losses in kW
60/60T	2.2
75/60T	2.7
100/60T	3
120/60T	3.5

2 - MECHANICAL INSTALLATION

• It is the responsibility of the owner or user to ensure that the installation, operation and maintenance of the drive and its options comply with legislation relating to the safety of personnel and equipment and with the current regulations of the country of use.
The drive must not be installed in hazardous areas unless it is in an appropriate enclosure. In this case the installation must be approved.

• In atmospheres where condensation may form, install a heating system which operates when the drive is not in use and is powered when the drive is in use. It is advisable to control the heating system automatically.

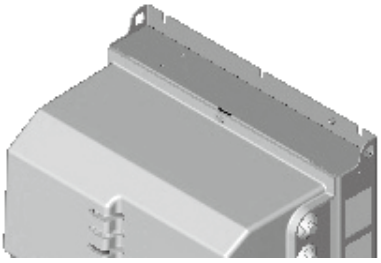
2.1 - Checks on receipt

Before installing the **POWERDRIVE**, check that:
- The drive has not been damaged during transport
- The information on the nameplate is compatible with the power supply

2.2 - Handling

• Check that the handling equipment is suitable for the weight to be handled.

• POWERDRIVE drives have two Ø 20 holes on the top and two Ø 20 holes on the bottom of the drive.



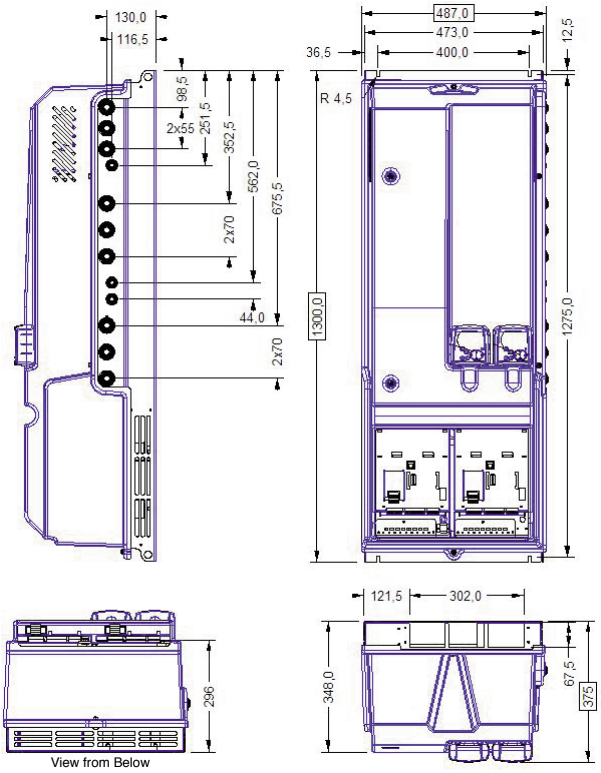
2.3 - Installation recommendations

• POWERDRIVE drives have optional IP20 protection.

• They are designed for installation in a cabinet or an enclosure to ensure protection from conducting dust and condensation and to prevent access by inexperienced personnel.

POWERDRIVE drives must be installed in a clean environment, away from conducting dust, corrosive gas and dripping water.
Otherwise, simply install them in an enclosure or a cabinet.
Mount the drive vertically, allowing a space of 100 mm above and below, 50 mm to the left and 150 mm to the right (for wiring).
Never obstruct the drive ventilation grilles.
If several drives are mounted in the same cabinet, check the opening cross-sections and the heat exchange between the drives. Do not place the drive above a heat source.

2.4 - Dimensions and weight



POWERDRIVE	Fixing screws	Weight (kg)
60/60T	6 x M8	75
75/60T	6 x M8	75
100/60 T	6 x M8	80
120/60 T	6 x M8	80

3 - CONNECTIONS

• All connection work must be performed in accordance with the laws in force in the country in which the drive is installed. This includes earthing to ensure that no directly accessible part of the drive can be at the mains voltage or any other voltage which may be dangerous.

• The voltages on the cables or connections of the mains supply, the motor, the braking resistor or the filter may cause fatal electric shocks. Contact must be avoided under all circumstances.

• The drive must be supplied via a circuit-breaking device so that it can be powered down safely.

• The drive power supply must be protected against overloads and short-circuits.

• The drive stop function does not protect against high voltages on the terminal blocks.

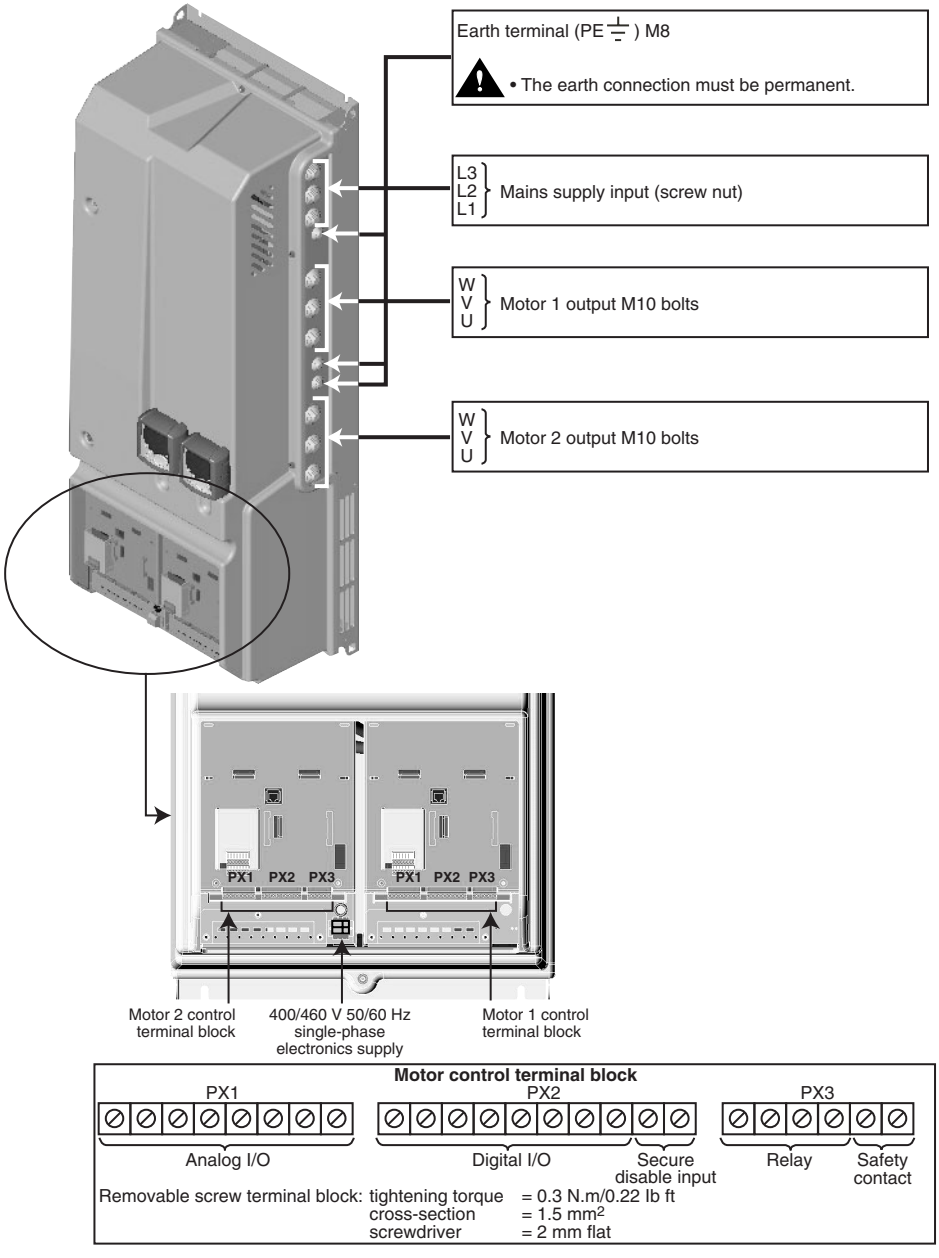
• Check that the DC bus voltage is below 40 V before carrying out any work.

• Check that the voltage and current of the drive, the motor and the mains supply are compatible.

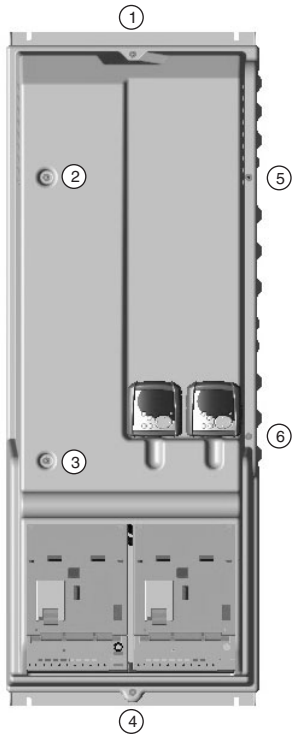
• After the drive has been operating, the heatsink may be very hot, therefore avoid touching it (70°C).

• Take special care with a drive installed in a device connected to the mains via fast-on connectors. The drive supply terminals are connected to internal capacitors via a diode bridge, which does not provide adequate insulation in this instance. It is therefore necessary to add an automatic insulation system for the fast-on connectors when they are not connected together.

3.1 - Control/power terminal block locations

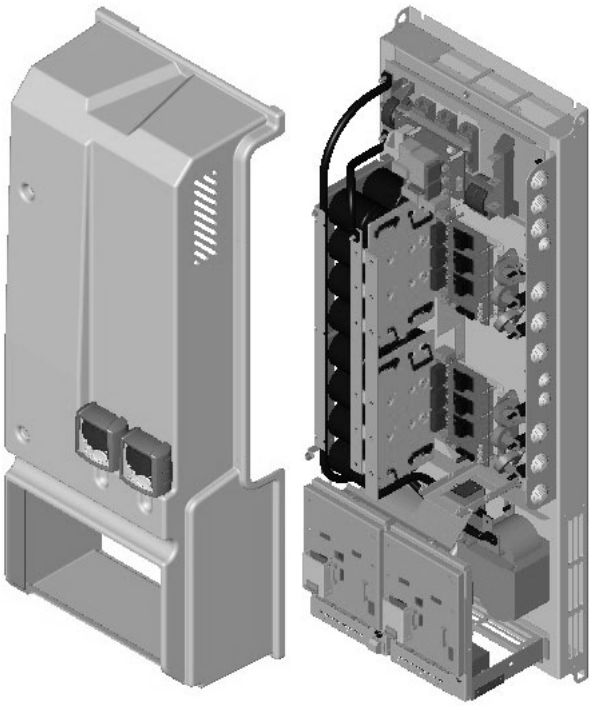


3.2 - Access to the power terminals



To access the power terminals on the IP20 version with cover (optional), remove the protective cover. Remove the 6 nuts marked ①, ②, ③, ④, ⑤ and ⑥.

3.3 - Wiring



For the IP20 version with cover (optional), use grommets to pass each wire through the Ø 36 openings.

3.4 - Connection of the power

3.4.1 - Secure disable input

This input, when open, causes the drive to lock. Independent of the microprocessor, it acts on several levels of control from the power bridge. It is designed in such a way that even if one or more circuit components were to fail, the absence of torque on the motor shaft is guaranteed with a very high level of integrity.
This input is used to create a safety function using the principles of category 1 or 3 of standard EN 954-1, depending on the application diagram.
The design of the "freewheel stop" function using input SDI2 is being evaluated by CETIM.
This results of this examination will be recorded in a report.
This built-in function enables the drive to act as substitute for a contactor in order to stop the motor in freewheel mode.
By using this secure disable input redundantly with another drive digital input, a diagram can be used which is capable of resisting a single fault. The drive will stop the motor in freewheel mode using two different control channels.
For correct use, the power connection diagrams described in the following paragraphs must be adhered to.
To unlock the drive and provide the safety function, secure disable input SD12 must be connected to the +24 V source SDI1.
This +24 V source should be reserved exclusively for the secure disable input function.

⚠ • The secure disable input is a safety component which must be incorporated into the complete system dedicated to machine safety. As for any installation, the complete machine must be the subject of a risk analysis by the integrator which will determine the safety category with which the installation must comply.

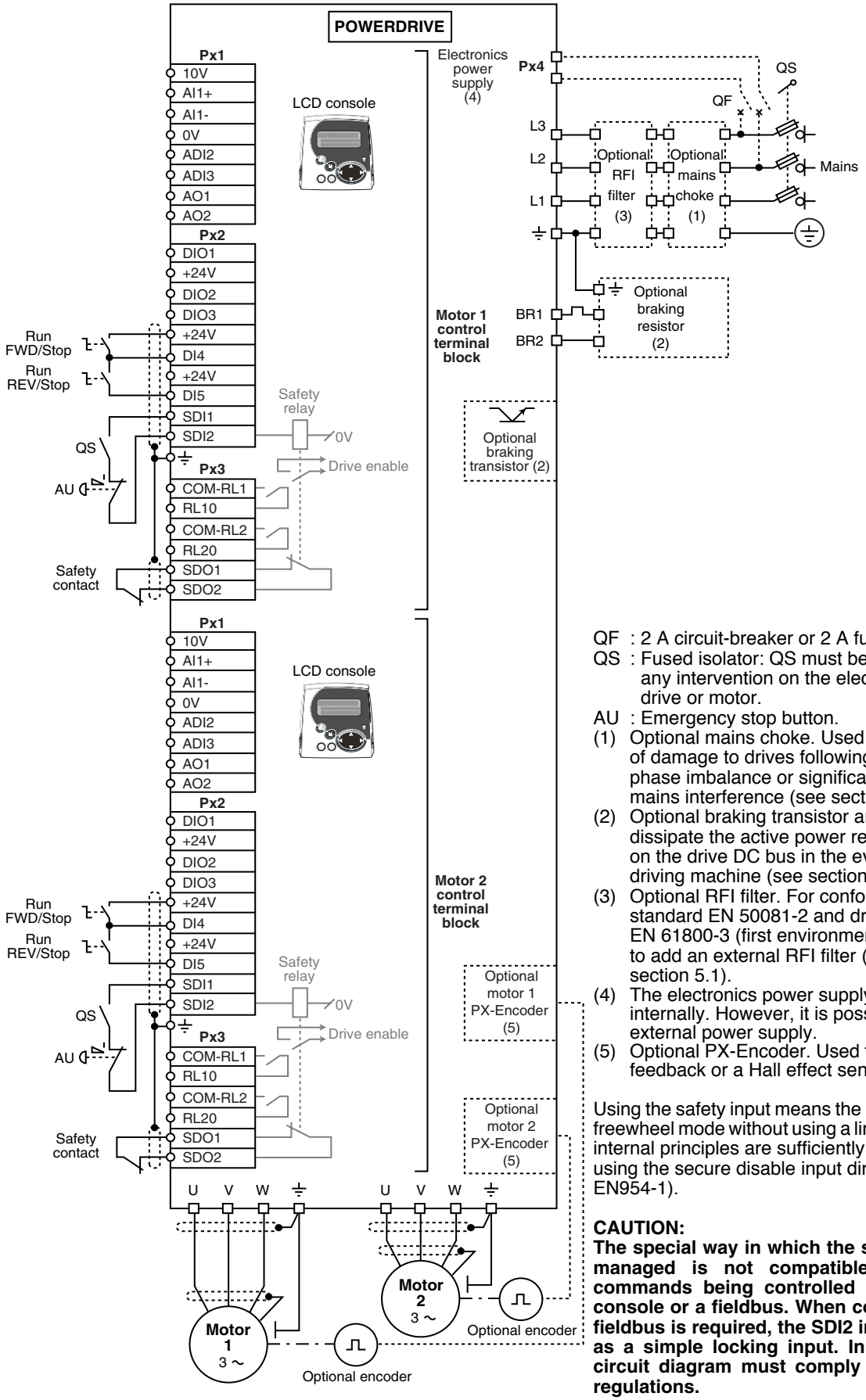
• The secure disable input, when open, locks the drive, meaning the dynamic braking function is no longer available. If a braking function is required before the drive safety lock is applied, a time-delayed safety relay should be installed to activate locking automatically after the end of braking.

If braking needs to be a machine safety function, it should be provided by an electromechanical solution since the drive dynamic braking function is not considered to be a safety function.

• The secure disable input does not provide the electrical isolation function. Before any work is carried out, the power supply must be cut by an approved isolating device (isolator, switch, etc).

• The safety function is not enabled when the drive is controlled via the keypad or via a fieldbus.

3.4.2 - 3-phase AC power supply



QF : 2 A circuit-breaker or 2 A fused isolator.
QS : Fused isolator: QS must be opened before any intervention on the electrical parts of the drive or motor.
AU : Emergency stop button.
(1) Optional mains choke. Used to reduce the risk of damage to drives following a phase imbalance or significant mains interference (see section 5.2).
(2) Optional braking transistor and resistor. Used to dissipate the active power returned by the motor on the drive DC bus in the event of a driving machine (see section 5.4).
(3) Optional RFI filter. For conformity with the generic standard EN 50081-2 and drive standard EN 61800-3 (first environment), it is necessary to add an external RFI filter (see section 4.6 and section 5.1).
(4) The electronics power supply is connected internally. However, it is possible to use an external power supply.
(5) Optional PX-Encoder. Used to manage the encoder feedback or a Hall effect sensor (see section 5.3).

Using the safety input means the motor can be stopped in freewheel mode without using a line contactor. The drive's internal principles are sufficiently safe to perform a stop using the secure disable input directly (category 1 of EN954-1).

CAUTION:
The special way in which the secure disable input is managed is not compatible with the Run/Stop commands being controlled by the POWERDRIVE console or a fieldbus. When control via a console or fieldbus is required, the SDI2 input should be viewed as a simple locking input. In this case, the power circuit diagram must comply with the usual safety regulations.

3.4.3 - Cables and fuses

• It is the responsibility of the user to connect and provide protection for the POWERDRIVE in accordance with the current legislation and regulations in the country of use. This is particularly important as regards the size of the cables, the type and rating of fuses, the earth or ground connection, powering down, acknowledging faults, insulation and protection against overcurrents.

• These tables are given for information only, and must under no circumstances be used in place of the current standards.

• **P1:** Output power 1
• **P2:** Output power 2
• **I_{co}:** Continuous output current

POWERDRIVE	P1+P2 max	Mains power supply										
		400 V - 50 HZ					460/480 V - 60 Hz					
		Current	Fuses		Cable cross-sections		Current	Fuses			Cable cross-sections	
			Type	Type	EN60204	UL508C		Type	Type	Class J	EN60204	UL508C
	(kW)	(A)	Gg	aR	(mm^2)	(AWG)	(A)	Gg	aR	(UL)	(mm^2)	(AWG)
60/60T	90	170	200	350	3x95	3x4/0	150	160	350	225	3x70	3x3/0
75/60T	100	190	200	400	3x120	3x250MCM	170	200	350	250	3x95	3x4/0
100/60T	120	225	250	400	3x150		200	250	400	300	3x120	3x250MCM
120/60T	120	225	250	400	3x150		200	250	400	300	3x120	3x250MCM

POWERDRIVE	Motor 1			Motor 2		
	I_{co} (1)	Cable cross-sections		I_{co} (1)	Cable cross-sections	
		EN60204	UL508C		EN60204	UL508C
	(A)	(mm^2)	(AWG)	(A)	(mm^2)	(AWG)
60/60T	90	3x35	3x2	90	3x35	3x2
75/60T	110	3x50	3x0	90	3x35	3x2
100/60T	145	3x70	3x(3/0)	90	3x35	3x2
120/60T	175	3x95	3x(4/0)	90	3x35	3x2

(1) The value of the rated current and the motor cable cross-sections is given for information only. The motor rated current permitted by the drive varies according to the switching frequency and the temperature.

Note:
• The mains current value is a typical value which depends on the source impedance. The higher the impedance, the lower the current.
• To determine the cross-section of the earth cables (in accordance with standard EN 60204):
- Phase cable cross-section ≤ 16 mm^2: use an earth cable with the same cross-section
- 16 mm^2 < phase cable cross-section ≤ 35 mm^2: the earth cable cross-section is 16 mm^2
- Phase cable cross-section > 35 mm^2: the earth cable cross-section must be half the phase cable cross-section (choose the cross-section that is equal to or higher than this value)

3.5 - Connection of the control

⚠ • The POWERDRIVE has a positive logic configuration. Using a drive with a control system which has a different control logic may cause unwanted starting of the motor.

• The control circuits in the drive are isolated from the power circuits by a single insulation (IEC 664-1). The installer must ensure that the external control circuits are isolated against any human contact.

• If the control circuits need to be connected to circuits conforming to SELV safety requirements, additional insulation must be inserted to maintain the SELV classification.

3.5.1 - Characteristics of control terminal blocks

3.5.1.1 - Characteristics of analog I/O terminal blocks (PX1)

1	10 V	+10 V internal analog source
Precision		± 2%
Maximum output current		20 mA

2	AI1+	Differential analog input 1 (+)
3	AI1-	Differential analog input 1 (-)
Characteristics		Bi-directional voltage (differential mode and common mode) or uni-directional current (common mode only, connect terminal 3 to the 0 V)
Resolution		13 bits + sign
Sampling		6 ms
Voltage input		
Full scale voltage range		±10 V ±2%
Maximum voltage		33 V
Input impedance		95 kΩ
Current input		
Current ranges		0 to 20 mA ±5%
Maximum voltage		33 V/0 V
Maximum current		50 mA
Input impedance		100 Ω

4	0 V	Logic circuit common 0 V

5	ADI2	Analog/digital input 2
Characteristics		Bi-directional voltage (common mode) or uni-directional current
Resolution		9 bits + sign
Sampling		6 ms
Voltage input		
Full scale voltage range		±10 V ±2%
Maximum voltage		33 V
Input impedance		95 kΩ
Current input		
Current ranges		0 to 20 mA ±5%
Maximum voltage		33 V/0 V
Maximum current		50 mA
Input impedance		100 Ω
Digital input (if connected to +24 V)		
Thresholds		0: < 5 V 1: > 10 V
Voltage range		0 to +24 V
Maximum voltage		33 V/0 V
Load		50 kΩ
Input threshold		7.5 V

6	ADI3	Analog or digital input or motor sensor (PTC)
Characteristics		Analog voltage (common mode)
Resolution		10 bits
Sampling		6 ms
Voltage input		
Full scale voltage range		10 V ±2%
Maximum voltage		33 V
Input impedance		50 kΩ
Digital input (if connected to +24 V)		
Thresholds		0: < 5 V 1: > 10 V
Voltage range		0 to +24 V
Maximum voltage		33 V/0 V
Load		95 kΩ
Input threshold		7.5 V
Motor sensor input		
Internal voltage		5 V
Fault trip threshold		≥ 3.3 kΩ
Drive reset threshold		< 1.8 kΩ

7	AO1	Analog output 1
8	AO2	Analog output 2
Characteristics		Bi-directional analog voltage (common mode) or uni-directional current
Resolution		AO1: 15 bits + sign
		AO2: 11 bits + sign
Sampling		6 ms
Voltage output		
Voltage range		±10 V
Load resistor		2 kΩ minimum
Protection		Short-circuit (40 mA max)
Current output		
Current ranges		0 to 20 mA
Maximum voltage		+10 V
On-load resistance		500 Ω maximum

3.5.1.2 - Characteristics of digital I/O terminal blocks (PX2)

1	DIO1	Digital input or output 1
3	DIO2	Digital input or output 2
4	DIO3	Digital input or output 3

Characteristics	Digital input or output (positive logic)
Thresholds	0: < 4 V 1: > 13.5 V
Voltage range	0 to +24 V
Sampling/refreshment	2 ms
Digital input	
Absolute maximum voltage range	0 V to +35 V
Load	15 kΩ
Digital output (open collector type)	
Overload current	50 mA

2 5 7	+24 V	+24 V internal source

Output current	100 mA in total
Precision	0 to -15%
Protection	Current limit and drive set to trip state

6	DI4	Digital input 4
8	DI5	Digital input 5

Characteristics	Digital input (positive logic)
Thresholds	0: < 4 V 1: > 13.5 V
Voltage range	0 to +24 V
Sampling/refreshment	2 ms
Absolute maximum voltage range	0 V to +35 V
Load	15 kΩ
Input threshold	7.5 V

9	SDI1	+24 V dedicated to the secure disable
10	SDI2	Secure disable/drive unlocking input

Characteristics	Digital input (positive logic)
Thresholds	0: < 5 V 1: > 18 V
Voltage range	9 V to 33 V
Impedance	820 Ω

3.5.1.3 - Characteristics of relay output terminal blocks (PX3)

1 2	COM-RL1 RL1O	N/O relay output

Characteristics	250 V AC output relay
Maximum contact current	• 2 A, resistive load • 1 A, inductive load

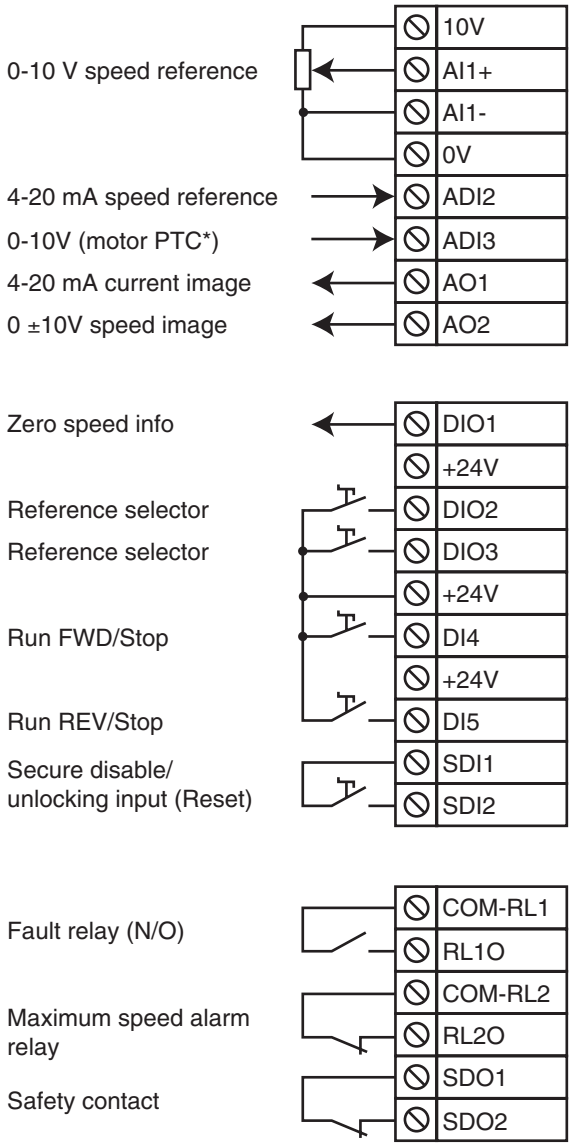
3 4	COM-RL2 RL2O	N/O relay output

Characteristics	250 V AC output relay
Maximum contact current	• 2 A, resistive load • 1 A, inductive load

5 6	SDO1 SDO2	Safety contact

Characteristics	250 V AC
Maximum contact current	• 2 A, resistive load • 1 A, inductive load

3.5.2 - Factory configuration of control terminal blocks



Note: Input SDI2 must be closed before executing the run command.

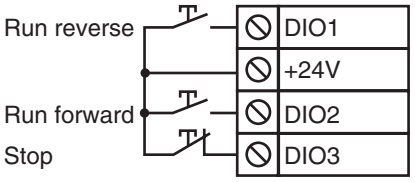
This configuration is obtained by returning to the "factory settings" (**00.45** = 50 Hz HIGH (1) or 50 Hz LOW (3)). This modification can only be made when the drive is disabled (SDI2 open).

• List of parameters to adjust:
00.47 = preset reference 2 value in rpm.
(*) If the motor thermal probe is to be connected on ADI3, set **00.28** = PTC, otherwise keep the factory value of **00.28** (0-10 V).

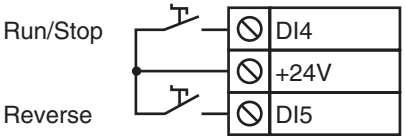
• Selection of the reference via digital inputs

DIO2	DIO3	Selection of
0	0	Voltage speed reference (0-10 V)
0	1	Current speed reference (4-20 mA)
1	0	Preset reference 2
1	1	

- For "3-wire" control (jog Run/Stop):
00.22 = Jog R/S (1)
This mode is not operational from the user menu. (If necessary, refer to parameter 06.04 in menu 6, commissioning manual ref. 3871).



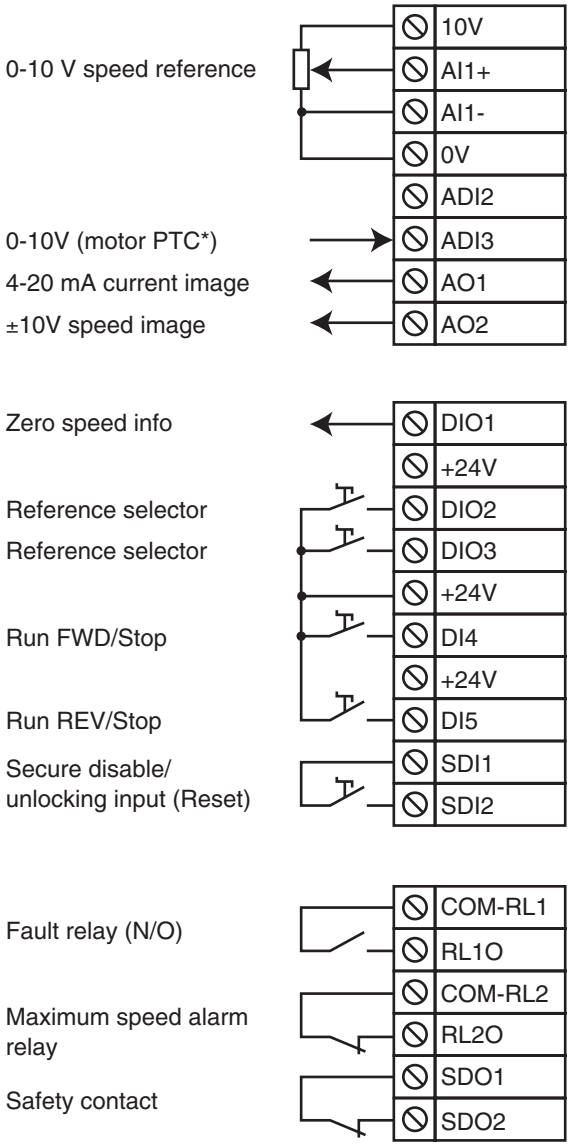
- In reverse direction: **00.22** = R/S + Reverse (2)



• List of parameters to adjust:
00.35 = **06.34**,
00.36 = **06.33**.

3.5.3 - Quick configuration of the control terminal block depending on the reference

3.5.3.1 - Configuration 1: Selection of a voltage reference (0-10 V) or 3 preset references via 2 digital inputs



Note: Input SDI2 must be closed before executing the run command.

- Parameters must be set with the drive disabled (SDI2 open).
- Parameter **00.22** is used to modify the run command type ("3-wire" or reverse command: refer to section 3.3.2).

• List of parameters to adjust based on the factory configuration

- Check that:

00.05 = via terminal (0).

- Set:

(*) If the motor thermal probe is to be connected on ADI3, set **00.28** = PTC, otherwise keep the factory value of **00.28** (0-10 V).

00.34 = **01.46** (DIO3 is configured as a digital input which can be used to select the reference).

00.47 = preset reference 2 value in rpm.

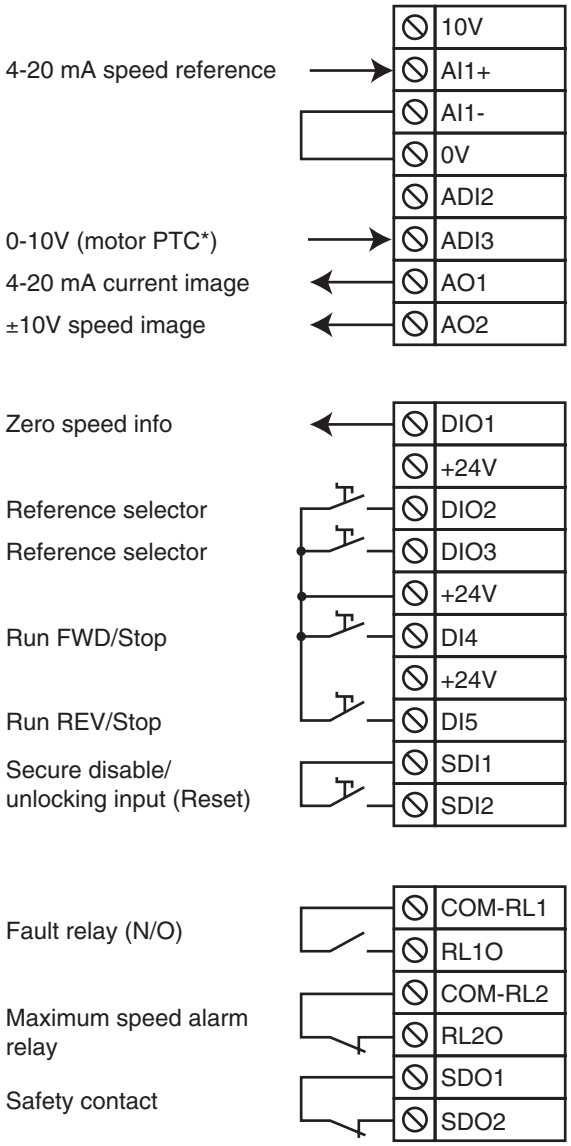
00.48 = preset reference 3 value in rpm.

00.49 = preset reference 4 value in rpm.

• Selection of the reference via digital inputs:

DIO2	DIO3	Selection of
0	0	0-10 V analog reference
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

3.5.3.2 - Configuration 2: Selection of a current reference (4-20 mA) or 3 preset references via 2 digital inputs



Note: Input SDI2 must be closed before executing the run command.

- Parameters must be set with the drive disabled (SDI2 open).
- Parameter **00.22** is used to modify the run command type ("3-wire" or reverse command: refer to section 3.3.2).

• List of parameters to adjust based on the factory configuration

- Check that:

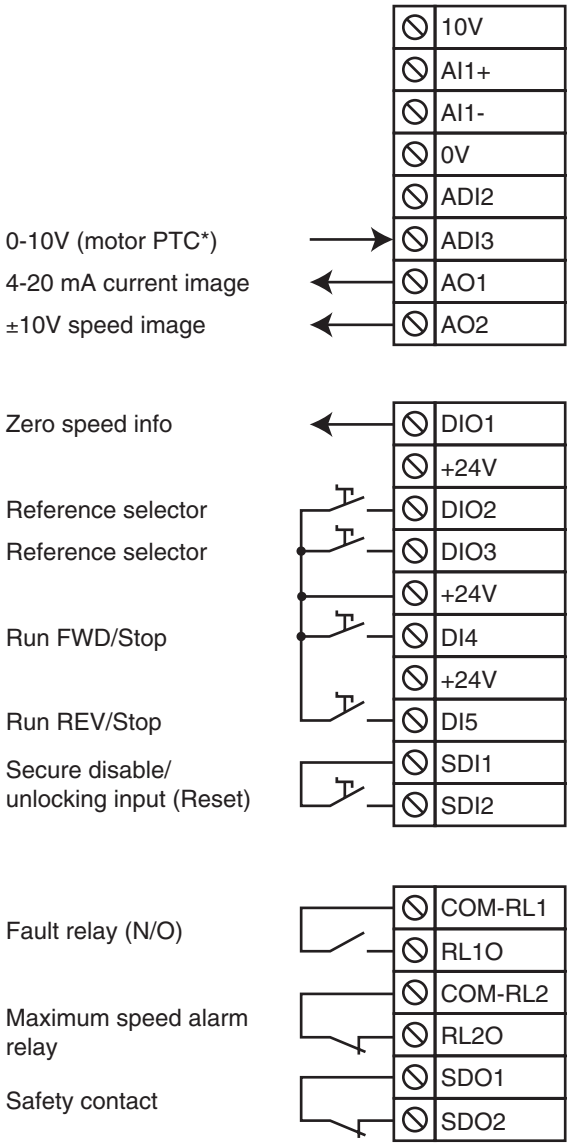
00.05 = via terminal (0).

- Set:

00.25 = 4-20mA sd (4) (AI1 is configured as an analog current input, 4-20mA range without detection of signal loss).
(*) If the motor thermal probe is to be connected on ADI3, set **00.28** = PTC, otherwise keep the factory value of **00.28** (0-10 V).
00.34 = **01.46** (DIO3 is configured as a digital input which can be used to select the reference).
00.47 = preset reference 2 value in rpm.
00.48 = preset reference 3 value in rpm.
00.49 = preset reference 4 value in rpm.

DIO2	DIO3	Selection of
0	0	4-20 mA analog reference
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

3.5.3.3 - Configuration 3: Selection of 4 preset references via 2 digital inputs



Note: Input SDI2 must be closed before executing the run command.

- Parameters must be set with the drive disabled (SDI2 open).
- Parameter **00.22** is used to modify the run command type ("3-wire" or reverse command: refer to section 3.3.2).

• List of parameters to adjust based on the factory configuration

- Set:

00.05 = preset ref. (4).

(*) If the motor thermal probe is to be connected on ADI3, set **00.28** = PTC, otherwise keep the factory value of **00.28** (0-10 V).

00.34 = **01.46** (DIO3 is configured as a digital input which can be used to select the reference).

00.46 = preset reference 1 value in rpm.

00.47 = preset reference 2 value in rpm.

00.48 = preset reference 3 value in rpm.

00.49 = preset reference 4 value in rpm.

DIO2	DIO3	Selection of
0	0	Preset reference 1
1	0	Preset reference 2
0	1	Preset reference 3
1	1	Preset reference 4

4 - GENERAL EMC - HARMONICS - MAINS INTERFERENCE

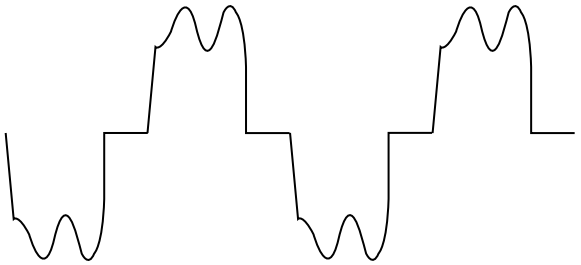
The power structure of frequency inverters leads to the occurrence of two types of phenomena:
- Low frequency harmonics fed back to the mains power supply
- Emission of radio-frequency signals (RFI)

These are independent phenomena. They have different consequences on the electrical environment.

4.1 - Low frequency harmonics

4.1.1 - General

The rectifier, at the head of the frequency inverter, generates a non-sinusoidal AC line current.



3-phase rectifier line current consumption

This current carries harmonics with number 6n ± 1.
Their amplitudes depend on the impedance of the mains supply upstream of the rectifier bridge, and on the structure of the DC bus downstream of the rectifier bridge.
The more inductive the mains supply and the DC bus, the more these harmonics are reduced.
They are only significant for loads on frequency inverters with several hundred kVA and if these loads represent more than a quarter of the total load on a site.
They have virtually no effect on the electrical energy consumption level. The temperature rises associated with these harmonics in transformers and motors directly connected to the mains supply are negligible.
It is very rare for these low frequency harmonics to cause interference on sensitive equipment.

4.1.2 - Standards

No standards have been imposed for current harmonics.
These current harmonics introduce voltage harmonics to the mains supply, **whose amplitude depends on the impedance of the mains supply.**
The energy supply company (EDF in France), which is affected by these phenomena in the case of **high power installations**, has its own **recommendations** for the level of each voltage harmonic:
- 0.6% for even numbers
- 1% for odd numbers
- 1.6% for the total factor

This applies to the connection point of the energy supply company and not at harmonic generator level.

4.1.3 - Reduction of the level of harmonics fed back to the mains supply

The low power ratio between the drive and the mains supply on which it is installed results in a level of voltage harmonics that is generally acceptable.
However, in the rare situations where the characteristics of the mains and the total load on the drives prevent compliance with the levels of harmonics recommended by the energy supply company, LEROY-SOMER will offer every assistance to the installer in calculating a mains choke or an additional sine filter.

4.2 - Radio-frequency interference: Immunity

4.2.1 - General

The immunity level of a device is defined by its ability to operate in an environment which has been contaminated by external elements or by its electrical connections.

4.2.2 - Standards

Each device must undergo a series of standard tests (European standards) and meet a minimum requirement in order to be declared as compliant with the variable speed drive standards (EN 61800-3).

4.2.3 - Recommendations

An installation consisting exclusively of devices which comply with the standards concerning immunity is very unlikely to be subject to a risk of interference.

4.3 - Radio-frequency interference: Emission

4.3.1 - General

Frequency inverters use high-speed switches (transistors, semi-conductors) which switch high voltages (around 550 V) and currents at high frequencies (several kHz). This provides better efficiency and a low level of motor noise.
As a result, they generate radio-frequency signals which may disturb operation of other equipment or distort measurements taken by sensors:
- Due to high-frequency leakage currents which escape to earth via the stray capacity of the drive/motor cable and that of the motor via the metal structures which support the motor.
- By conduction or feedback of R.F. signals on the power supply cable: **conducted emissions**
- By direct radiation near to the mains supply power cable or the drive/motor cable: **radiated emissions**
These phenomena are of direct interest to the user.
The frequency range concerned (radio frequency) does not affect the energy supply company.

4.3.2 - Standards

The maximum emission level is set by the standards for variable speed drives (EN 61800-3).

4.3.3 - Recommendations

• Experience has shown that the levels set by the standards do not necessarily need to be observed to eliminate interference phenomena.
• Following the basic precautions in the paragraph below generally results in the correct operation of the installation.

4.4 - Influence of the mains power supply

The mains power supply may be subject to interference (voltage drops, voltage imbalances, fluctuation, overvoltages, etc.) which can have an actual negative impact on the performance and reliability of all electronic power equipment, including drives.
LEROY-SOMER drives are designed to operate with a mains power supply typical of industrial sites throughout the world. However, for each installation, it is important to know the characteristics of the mains power supply in order to carry out corrective measures in the event of abnormal conditions.

4.4.1 - Transient overvoltages

There are numerous reasons for overvoltages on an electrical installation:
- Connection/disconnection of a bank of capacitors which increases the cos φ.
- Short-circuit in a high-power device when an isolator is opened and/or fuses are damaged.
- Devices (ovens, DC or AC drives, etc.) with high-power thyristors (>1 MW).
- High-power motors during start-up.
- Overhead power supply.
- Etc.

The **POWERDRIVE** incorporates high-power overvoltage limiters, which protect the drive and enable reliable operation on industrial sites.
If transient overvoltages are a regular occurrence, we recommend the use of a mains choke.

4.4.2 - Unbalanced power supply

In the same way as what is observed on an electric motor, the line current imbalance of a drive operating on an unbalanced mains supply may be several times the value of the voltage imbalance measured on the power supply.
A highly unbalanced mains supply (>2%) combined with a low mains impedance may result in a high level of stress on the components at the input stage of a drive.

Mains chokes can be installed upstream of a **POWERDRIVE** supplied by an unbalanced mains supply in order to reduce the current imbalance factor.

4.4.3 - Impedance of the mains supply

The **POWERDRIVE** is designed to operate in industrial electrical networks that have a transformer suitable for a power level between 20 and 100 times the rated power of the drive (1% < line impedance <5%).
However, if the **POWERDRIVE** is installed near to the MV/LV power supply transformer or if a bank of capacitors which increases the cos φ is used, the impedance experienced by the **POWERDRIVE** is very low. In this case we recommend that you use a mains choke upstream of the drive in order to obtain an equivalent line impedance higher than 1%.

4.4.4 - Ground connections

The earth equipotential of some industrial sites is not always observed. This lack of equipotential leads to leakage currents which flow via the earth cables (green/yellow), the machine chassis, the pipework, etc. but also via the electrical equipment.
In extreme cases, these currents may cause drive malfunctions (spurious faults).
It is essential that the recommendations in paragraph 4.5 are observed in order to minimise the impact of these currents.

4.5 - Basic precautions for installation

These are to be taken at the design stage and also when wiring the cabinet and the external components. In each paragraph, they are listed in decreasing order of effect on correct operation of the installation.

4.5.1 - Installation of the drive and associated components in the cabinet

- Screw the drive and the components onto a metal grille or a base plate which is unpainted or paint-free at the fixing points.
- Fix the plate at several paint-free points at the back of the cabinet.

4.5.2 - Wiring inside the cabinet

- Do not run the control cables and the power cables in the same cable ducts (minimum distance 0.5 m).
- For control cables, use shielded twisted cables.

4.5.3 - Wiring outside the cabinet

- Connect the motor earth terminal directly to that of the drive.
- Use shielded motor power supply cables. The shielding should be connected at both ends: drive end and motor end.
- In the second industrial environment, the shielded motor power supply cable can be replaced by a 3-core + earth cable placed in a fully enclosed metal conduit (metal cable duct for example). This metal conduit should be mechanically connected to the electrical cabinet and the structure supporting the motor. If the conduit consists of several pieces, these should be interconnected by braids to ensure earth continuity. The cables should be fixed securely at the bottom of the conduit.
- There is no need to shield the power supply cables between the mains supply and the drive.
- Isolate the power cables from the control cables. The power cables must intersect the other cables at an angle of 90°.
- Isolate sensitive elements (probe, sensors, etc.) from metal structures which may be shared by the motor support.

4.5.4 - Importance of ground wiring

The immunity and radio-frequency emission level are directly linked to the quality of the ground connections. Metal grounds should be mechanically connected to each other with the largest possible electrical contact area. Under no circumstances can the earth grounds, which are designed to protect people by linking metal grounds to earth via a cable, serve as a substitute for the ground connections.

4.6 - Electromagnetic compatibility (EMC)

CAUTION:
Conformity of the drive is only assured when the mechanical and electrical installation instructions described in this manual are adhered to.

Immunity			
Standard	**Description**	**Application**	**Conformity**
IEC 61000-4-2 EN 61000-4-2	Electrostatic discharges	Product casing	Level 3 (industrial)
IEC 61000-4-3 EN 61000-4-3	Immunity standards for radiated radio-frequency	Product casing	Level 3 (industrial)
IEC 61000-4-4 EN 61000-4-4	Bursts of fast transients	Control cable	Level 4 (industrially hardened)
		Power cable	Level 3 (industrial)
IEC 61000-4-5 EN 61000-4-5	Shock waves	Power cables	Level 4
IEC 61000-4-6 EN 61000-4-6	Generic immunity standards for conducted radio-frequency	Control and power cables	Level 3 (industrial)
EN 50082-2 IEC 61000-6-2 EN 61000-6-2	Generic immunity standards for the industrial environment	-	Up to the required standard
EN 61800-3 IEC 61800-3 EN 61000-3	Variable speed drive standards	Conforms to the first and second environment	

Emission			
Standard	**Description**	**Application**	**Conformity conditions according to the switching frequency** **- Switching frequency < 4 kHz** **- Cable length < 100 m**
EN 61800-3	Variable speed drive standards	Second environment	Up to the required standard
		First environment with restricted distribution (I)	External filter (optional)
EN 50081-2 EN 61000-6-4	Generic emission standards for the industrial environment	Industrial environment	External filter (optional)

• In accordance with IEC 61800-3, in the first environment, the POWERDRIVE is a device from the restricted distribution class. In a residential environment, this device may cause radio-electrical interference. In this case, the user may be asked to take appropriate action.

5 - EXTENSIONS TO OPERATING PARAMETERS

5.1 - RFI filters

5.1.1 - General

The use of RFI filters contributes to a reduction in the emission levels of radio-frequency signals. They ensure that **POWERDRIVE** components conform to directives EN 61000-6-4 regarding conducted and radiated radio-frequency emissions.
Depending on the drive used, install the RFI filter recommended in the table below between the mains and the drive input.

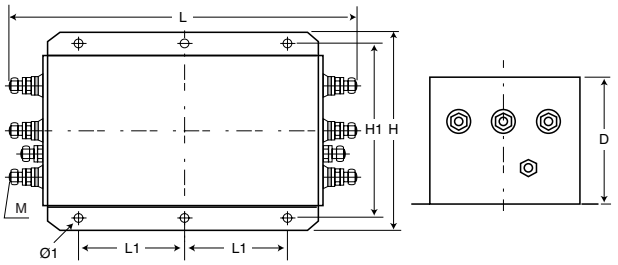
POWERDRIVE Rating	RFI filter Reference	I_{rated} (A)	Leakage current (mA)	Losses (W)
60/60 T 75/60 T	FN 3359 HV - 180	180	<6	38
100/60 T 120/60 T	FN 3359 HV -250	250	<6	57

The following rules must be observed when using filters:
- Mount the **POWERDRIVE** in a metal cabinet observing the recommendations for wiring in the paragraphs above.
- Install the filter as close as possible to the incoming supply of the cabinet. Screw the filter onto the same base grille as the drive.

CAUTION:
The use of an RFI filter is not recommended on an installation with neutral IT point connection. In addition to the fact that their contribution is negligible with regard to compliance with standards measured at the connection point of the energy supply company, their stray capacity can affect the operation of permanent insulation monitors.

5.1.2 - Weight and dimensions

• FN 3359 HV - 180 and FN 3359 HV - 250



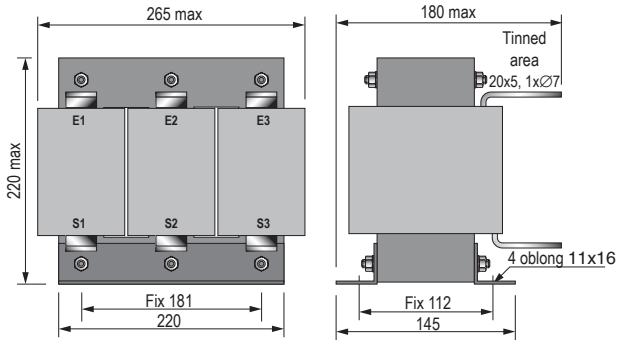
Type	Dimensions (mm) L	L1	H	H1	D	Ø1	Weight (kg)
FN 3359 HV-180	360	120	210	185	120	12	6.5
FN 3359 HV-250	360	120	230	205	125	12	7

5.2 - Mains choke

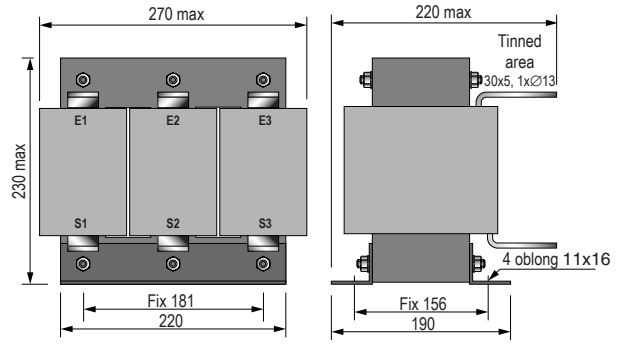
Mains chokes can be used to reduce the risk of damage to the drives following a phase imbalance or significant interference on the mains supply.
The recommended reactance for the mains chokes should be in the order of 2%, making it possible to tolerate a phase imbalance of 5%. An additional value can be used, but this can cause a loss at the drive output (reduction in torque at high speed) due to a reduction in voltage.
Install one line choke for each drive, connected upstream of the drive.

POWERDRIVE Rating	Choke Reference	I_{rated} (A)	Inductance (mH)	Losses (W)	Weight (kg)
60/60 T	176 ST 0.14	180	0.14	170	30
75/60 T 100/60 T 120/60 T	292 ST 0.085	292	0.085	200	30

• 176 ST 0.14



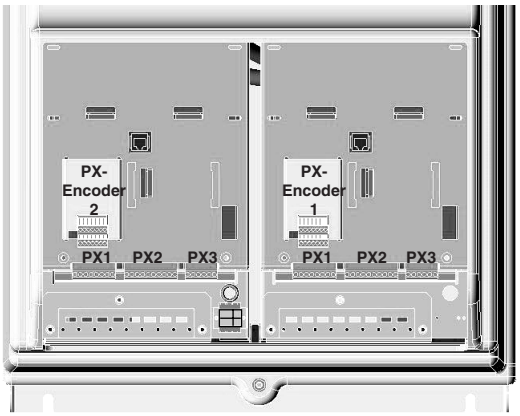
• 292 ST 0.085

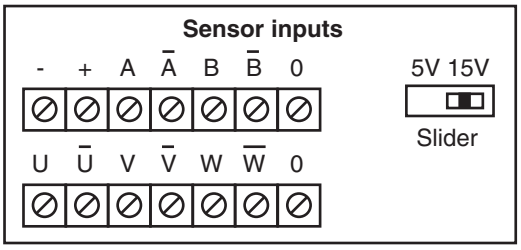


5.3 - Encoder feedback

The PX-Encoder option can be used to manage the motor encoder feedback. A PX-Encoder option must be installed for each encoder feedback (motor 1 and motor 2).

5.3.1 - Installation and connection





5.3.2 - Characteristics of terminal blocks

Upper terminal block

-	Sensor power supply 0 V
+	Sensor power supply depending on the position of the selector switch (slider) 5 V or 15 V
A	Connection of incremental encoder channels and 0 Marker (do not use with a Hall effect sensor)
\A	
B	
\B	
0	

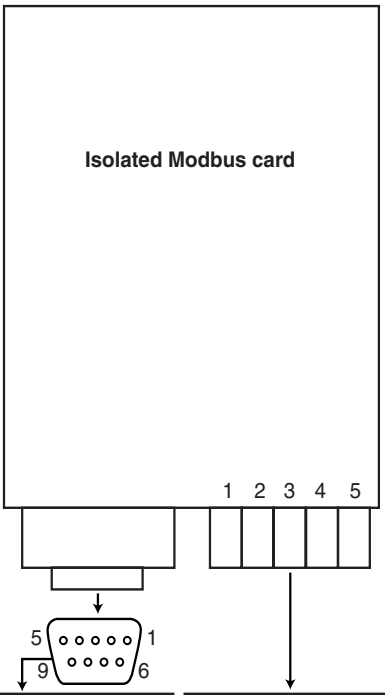
CAUTION:
Check the position of the switch: 15 V for supplying Hall effect sensors.

Lower terminal block

U	• Channel U of the incremental encoder (servo) • Not used with Hall effect sensor
\U	• Channel U\ of the incremental encoder (servo) • Channel 1 Hall effect sensor of the Hall effect
V	• Channel V of the incremental encoder (servo) • Not used with Hall effect sensors
\V	• Channel V\ of the incremental encoder (servo) • Channel 2 Hall effect sensor
W	• Channel W of the incremental encoder (servo) • Not used with Hall effect sensors
\W	• Channel W\ of the incremental encoder (servo) • Channel 3 Hall effect sensor
0	• Channel O\ of the incremental encoder (servo) • Not used with Hall effect sensors

5.4 - Modbus RTU card

The **POWERDRIVE** incorporates as standard a non-isolated 2-wire RS485 serial link port accessible with the RJ45 connector. When the user wishes to keep the LCD console permanently connected, it is necessary to add the Modbus RTU option with an isolated 2 or 4-wire serial link port.



Female 9-pin Sub D	
Pin	**Description**
1	0V
2	TX\
3	RX\
4	not connected
5	not connected
6	TX
7	RX
8	not connected
9	not connected
Shielding: 0V	

5-point screw terminal block	
Terminal	**Description**
1	0V
2	RX\
3	RX
4	TX\
5	TX

Notes

Notes

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